ORIGINAL ARTICLE

COMPARISON OF SITE OF BOND FAILURE BETWEEN TWO DIFFERENT PLIERS

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ABSTRACT

Debonding of orthodontic brackets is the last step of orthodontic treatment. This step should be performed carefully and with the best available method. The purpose of this study was to compare the site of bond failure after debonding brackets by debonding plier and crown remover.

One hundred sixty newly extracted premolars were bonded with metal brackets and randomly assigned to two study groups (n = 80).In one group brackets were debonded with debonding plier(DR) using base method while in other group brackets were debonded with crown remover(CR). Enamel surface after debonding was subsequently assessed visually for any adhesive remnant and adhesive remnant index (ARI) scoring based on 4 scores from 0 to 3 was applied. The ARI scorings of these two pliers were cross tabulated.

The site of bond failure was mostly within the adhesive after debonding with crown remover while it was at enamel adhesive interference after debonding with debonding plier.

It was concluded that crown remover is safer in terms of enamel integrity than debonding plier.

INTRODUCTION

Debonding of orthodontic brackets is the last step of orthodontic treatment. This step should be performed carefully and with the best available method. A careless debonding technique and approach can cause irreversible damage to outermost fluoride rich layer of enamel[1] thus increasing future incidence of caries.[2]

Site of bond failure is very important during debonding. Bond failure during debonding can occur at bracket adhesive interference, enamel adhesive interference or combination of two.[3] Though controversial[4,5] but it is generally believed[6,7] that bond failure at enamel adhesive interference should be avoided to prevent risk of enamel damage.

A crucial step at end of debonding is to evaluate site of bond failure. An accurate assessment of site of bond failure will allow the clinician to select an optimum method for adhesive remnant removal from the enamel surface. Site and type of bond failure after debonding is usually accessed[8] by adhesive remnant index (ARI). ARI developed by Artun and Bergland[9] is a tooth surface assessment index[10] that qualitatively assess the amount of remnant adhesive left on the enamel surface after debonding.

Conventionally orthodontic metal brackets are debonded by different mechanical methods. In these methods different type of pliers are used to debond brackets. A well accepted mechanical method to debond brackets is to use a debonding plier.[11] For effective debonding without distorting the brackets, the debonding plier is placed at the level of bracket base. Debonding of orthodontic brackets can also be done by crown removers used in prosthodontics.[12]

The study was based on null hypothesis that there is no difference between site of bond failure between these pliers and bond failure mainly occurs at bracket adhesive interference. The rationale of this study is to compare the site of bond failure between conventional debonding technique by using debonding plier with base method and crown removing plier so that the clinician can choose the best technique for debonding and for adhesive removal after debonding.

METHODOLODY

A total of one hundred sixty healthy premolars extracted for orthodontic purpose were collected from oral surgery department of Sharif Medical City, Lahore and CMH Medical and Dental College, Lahore. These premolars were stored in an aqueous solution of thymol (0.1% wt/vol). Each premolar was mounted in a custom made soft plaster jig. Buccal surface of each premolar was bonded with new stainless steel brackets. Same luting composite (Transbond XT 3M Unitek) was used to bond all premolars. The brackets

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Received for Publication: January 8, 2015
Revision Revised: March 24, 2015
Revision Accepted: March 28, 2015

were debonded after 24 hours. The teeth were randomly assigned to one of two study groups (n=80) for either debonding with debonding plier (n=80) or spring type crown remover (n=80). A base method of debonding was used with debonding plier (Fig 1A & B) while crown remover was also engaged at the level of bracket base (Fig 2A & B) before debonding. After debonding each tooth was accessed for ARI score. ARI score was taken from Artun and Bergland study[9] and is given in Table 1.

RESULTS

Of the 160 brackets debonded in this study, 80 were debonded with debonding plier (DR) and the other 80 were debonded with crown remover (CR). ARI score was measured and the data was entered into SPSS version 20 for windows and analyzed. Cross tabulation was done to see frequency of different scores attained by each plier and to compare efficacy of these two pliers (Table 2). Cross tabulation results show more than 50% incidence of bond failure at enamel adhesive interference (ARI score 0) with debonding plier. Debonding by

TABLE 1: ADHESIVE REMNANT INDEX

Score	Adhesive left on the tooth
0	No adhesive left on the tooth
1	Less than half of the adhesive left on the tooth
2	More than half of the adhesive left on the tooth
3	All adhesive left on the tooth, with distinct impression of the bracket mesh

TABLE 2: CROSS TABULATION

Efficacy Score		Plier		Total
		CR	DB	
Score 0	Count	18	43	61
	% within Plier	22.5%	53.8%	38.1%
Score 1	Count	26	17	43
	% within Plier	32.5%	21.3%	26.9%
Score 2	Count	26	8	34
	% within Plier	32.5%	10.0%	21.3%
Score 3	Count	10	12	22
	% within Plier	12.5%	15.0%	13.8%

TABLE 3: CHI-SQUARE TEST

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.841a	3	.000
N of Valid Cases	160		

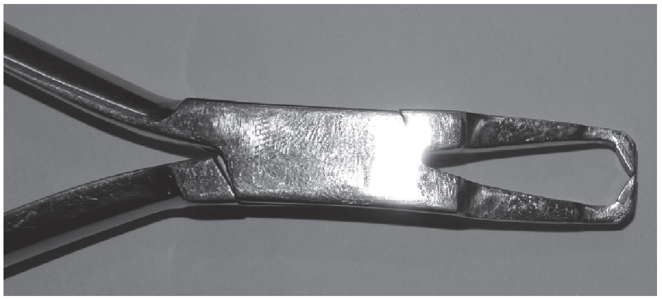

Fig 1A: A bracket debonding plier

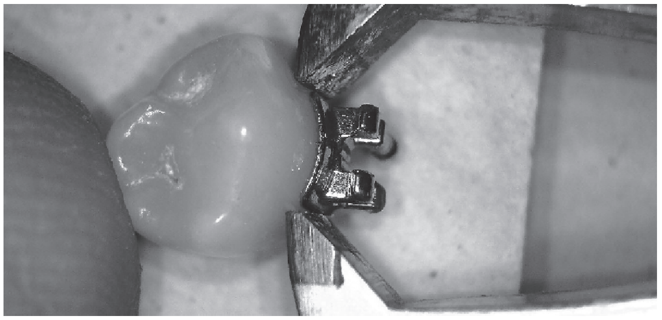

Fig 1B: Base method of debonding used with debonding plier

Fig 2 A: An automatic spring type crown remover

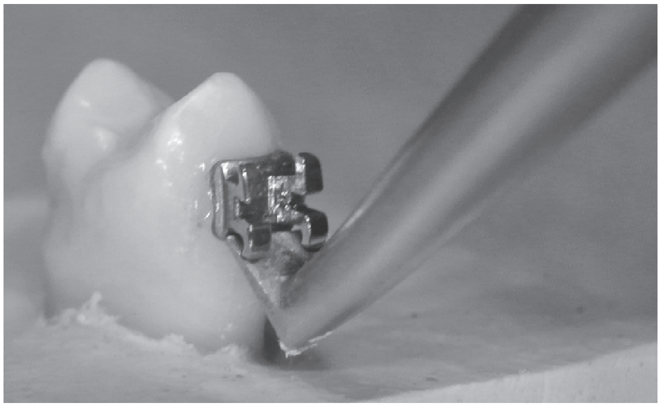

Fig 2 A: An automatic spring type crown remover placed at the level of bracket base during debonding

crown remover showed cohesive bond failure within the adhesive, with ARI scoring mainly in 2 & 3 categories. Chi-square ($\chi 2$) test was used to compare the categorical data. The results shows a significant difference between efficacy of the two pliers, $\chi 2 = 21.841$, $p < .001$ (Table 3).

DISCUSSION

The ARI scoring system is easy and quick method that has proved to be very valuable in deciding the site of bond failure. There is also significant direct correlation between ARI and Ca remnants[13,14] thus showing the amount of enamel loss during debonding.

Apart from debonding technique the site of bond failure is also influenced by oral environment, type of adhesive used[10,15-17] and its filler contents,[18,19] the bonding technique[20] and the bracket base mesh design.[21] So debonding technique should not be taken as sole indicator of site of bond failure.

Base method of debonding was preferred in this study as the blades of debonding plier and so its line of action of force coincides with the adhesive layer[13] thus resulting in consistent separation of the bracket from the tooth during debonding. In debonding by debonding plier more than 50% of bond failure occurred at enamel adhesive interference. So it can be assumed that debonding plier is not safe in term of enamel integrity. These findings are similar to Brosh study[13] where base method of debonding showed bond failure site closer to enamel surface (68.7%) and increased Ca remnants (54.47%) on the bracket base.

In this study mixed type of bond failure was prevalent within the adhesive with spring type crown remover. So it can be assumed that spring type crown remover is safer than debonding plier in terms of enamel integrity. In present study only 12.5% of bond failure with crown remover occurred at bracket adhesive interference. In a previous study on debonding by crown removal, Knösel et al[12] found that bond failure site was either within the adhesive or at bracket adhesive interference. No bond failure was reported at enamel adhesive interference in that study which is in contrast to present study where 22.5% bond failure occurred at enamel adhesive interference. This can be due to difference in type of crown remover used in our study. In our study the crown remover used, deliver a sudden shear type force by spring action to the bracket while in Knösel et al[12] study the crown remover deliver air pressure driven pulse shear forces to the bracket.

Though qualitative ARI score has low[22] interobserver and intraobserver variability but a study by David[23] found that quantitative ARI studies better than qualitative ARI studies. As crown remover is something new for bracket debonding and present study is done qualitatively so further quantitative studies should be done before fully integrating crown remover as a routine part of debonding procedure.

CONCLUSION

The original null hypothesis was rejected, the statistics showed significant differences between ARI scores of debonding plier and crown remover. From the study the following conclusion can be made:

- Site of bond failure is at enamel adhesive interference in case of debonding plier. In case of crown remover a mixed type bond failure occur this is basically cohesive and mainly occur within the adhesive.
- Crown remover is safer in terms of enamel integrity than debonding plier.
- More studies are needed to be done before integrating crown remover as a regular part of debonding procedure.

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